MINISTERUL CERCETĂRII, INOVĂRII ŞI DIGITALIZĂRII

TRD-2D
mCBM 2022 data taking campaign
Prototype construction

Alex Bercuci for the TRD-2D group

- *A. Bercuci*
- *V. Catanescu*
- *M. Petris*
- *M. Petrovici*
- *L. Radulescu*
- *C. Schiaua*
- *C. Andrei*
- *V. Aprodu*
- *G. Caragheorgheopol*
- *V. Duta*
- *A. Nan*
- *A. Pop*
- *L. Prodan*
- *A. Radu*
- *G. Stoian*
- *M. Tarzila*

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DFH weekly meeting
18th March 2022

Overview

→ *In the previous meeting (25.10.2021)*

→ A detailed description of **the detector and its design performances** were presented as they are included in the TRD **TDR Addendum**.

→ First **results from mCBM July 2021** data taking campaign were shown.

→ *In this meeting (18.03.2022)*

→ Final TRD2D chamber - **Prototype construction** status

→ Further data taking at SIS18 with the **mCBM; (dry runs, CR, C-Ni)**

→ Software development; (**monitoring, reconstruction, simulations**)

Details are discussed using the following communication channels

- TRD-2D @ DFH
- TRD @ CBM
- mCBM operation
- mCBM Data Analysis & Simulations
- DAQ
- CBM Redmine
- CERN Mattermost
- CBM GItLab

Prototype construction

Components

- entrance window 2 pcs
  (1st ready, 2nd prepared) (A.Radu)
- chamber ledges (final touches)
- wire comb 1.5 mm (A.Radu/V. Duta)
- wire comp 3 mm (M. Petris)
- araldite, Anode w, Cathode w (M. Petris)
- backplane components (D. Bartos)

Construction toolbox

- Wire winding machine (C. Andrei)
- Wire tension measuring device
  (C. Andrei)
- Chamber mounting device
  and technology (V.Duta)

aob

- Continuous filling
  and emptying list

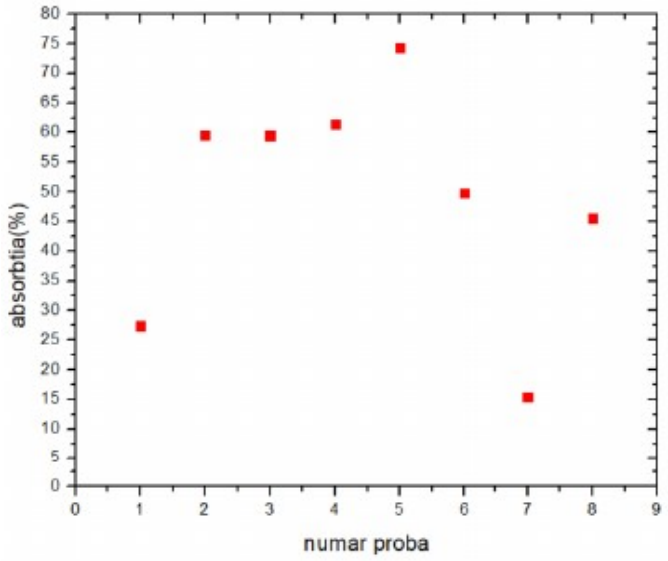
Quality Assurance Tests

- pad-plane connectivity (V.Aprodu, L.Prodan)
- mechanical and absorption tests
  for the entrance window (D.Dorobantu)
- ledges mechanical tolerance, gas box (L.Radulescu)

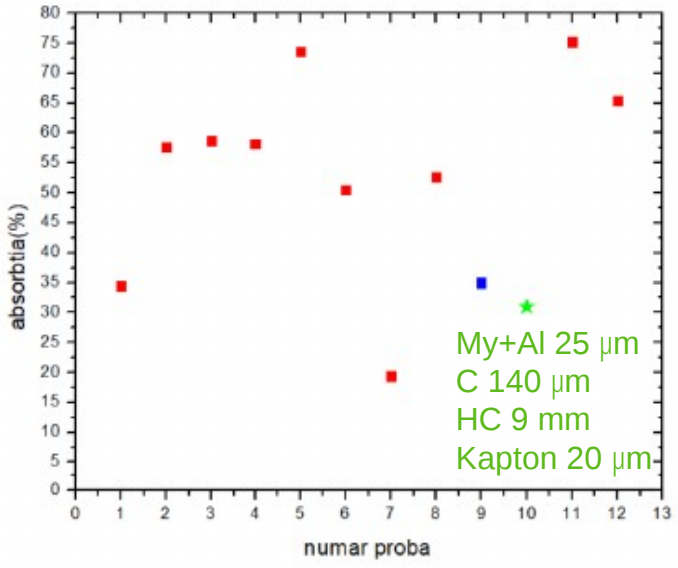
Entrance window absorption tests for better PID performances

Determinarea coeficientului de absorbție cu ajutorul TRD

Distanta mica (27 mm)
Iluminarea centrului structurii honeycomb

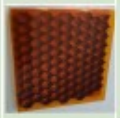


Distanta mare (16 cm)
Iluminarea uniforma



Legenda

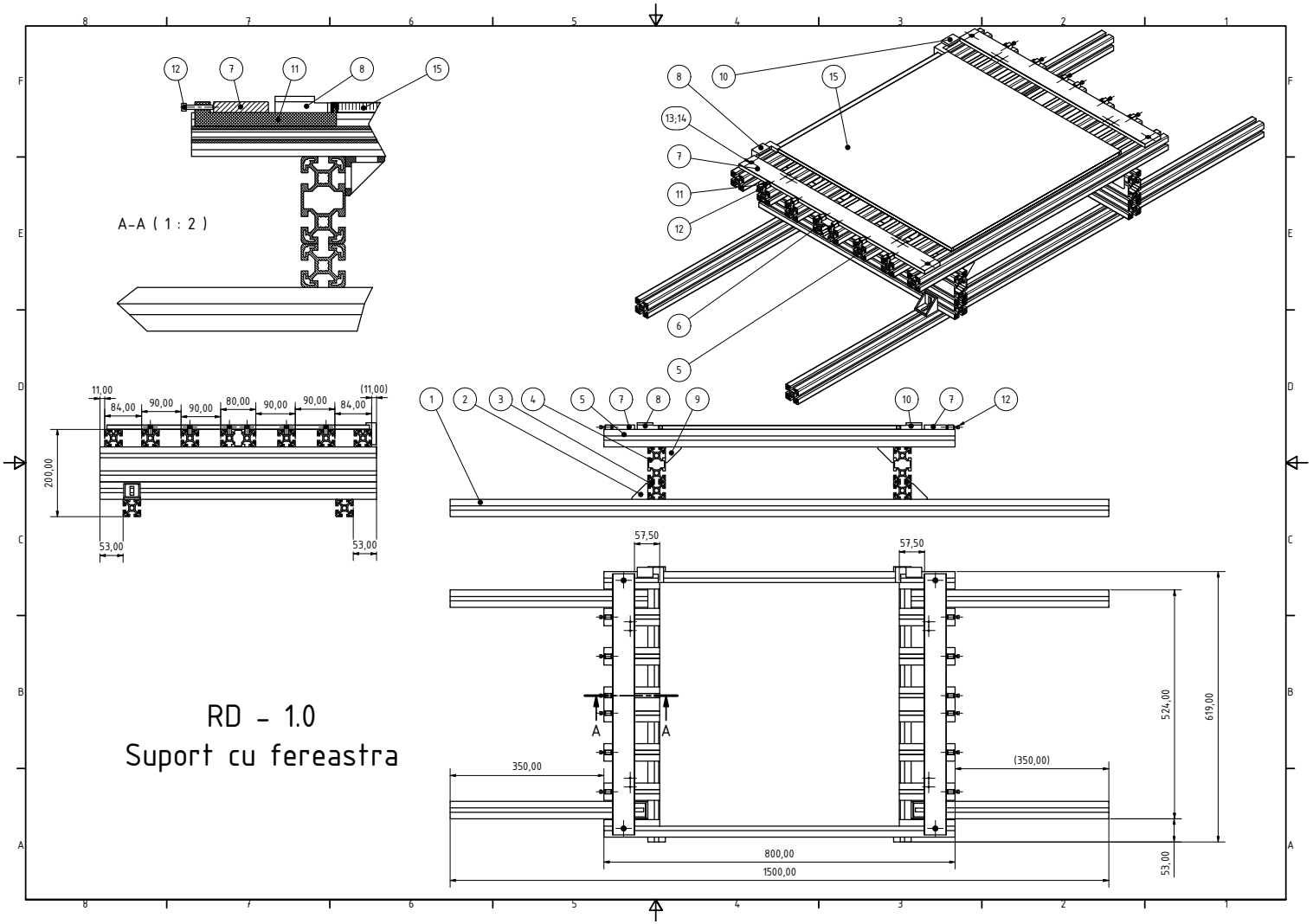
11

Nr.	Probă	Nr.	Probă
1		5	
2		6	
3		7	
4		8	
11		12	

D. Dorobantu et al., Studii de optimizare a ferestrei de intrare a detectorului de radiație de tranziție pentru experimentul CBM

D. Dorobantu et al., *Entrance window for the TRD-2D chambers for the CBM experiment,* CBM Progress Report 2021, in preparation

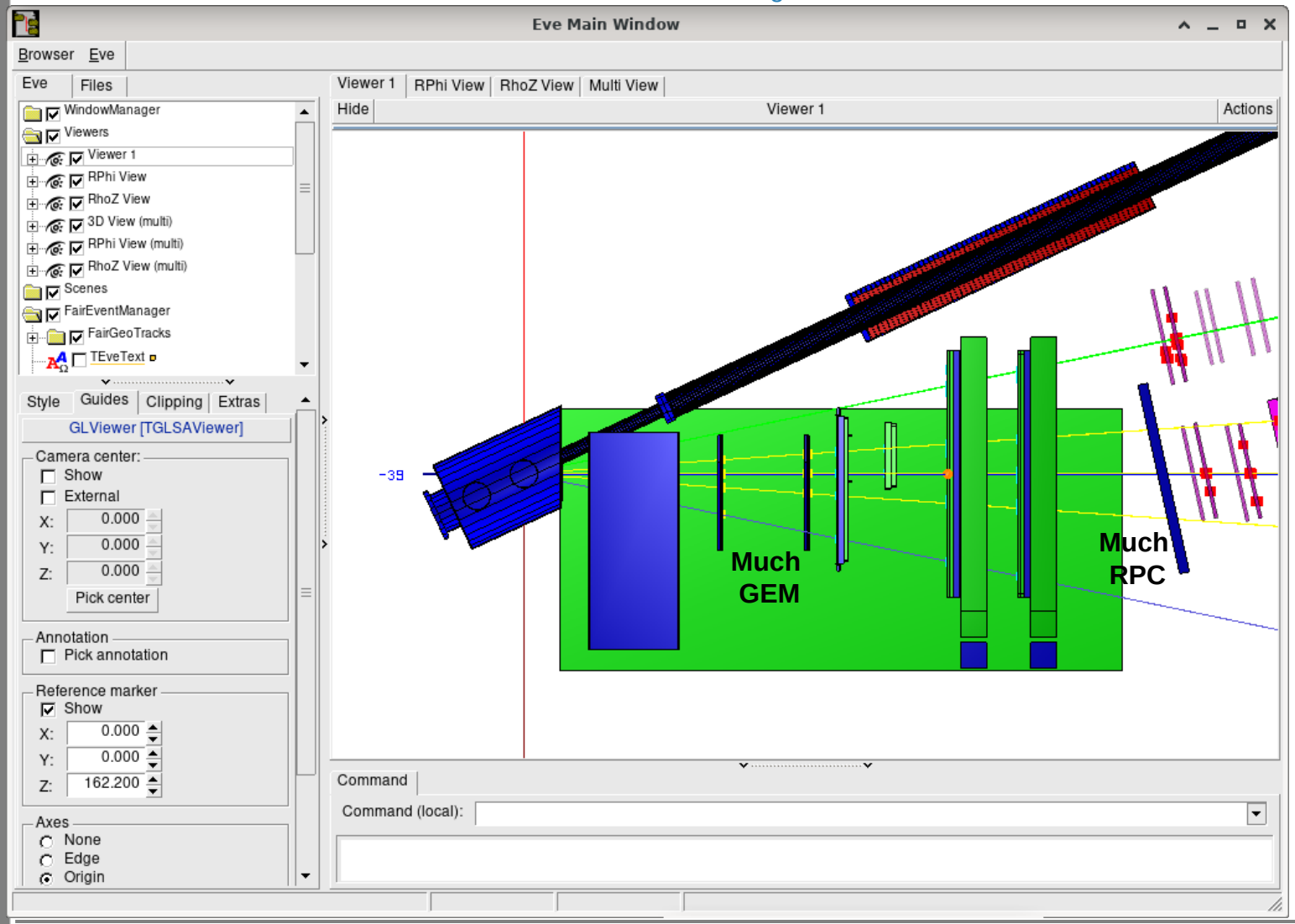
Chamber mounting device



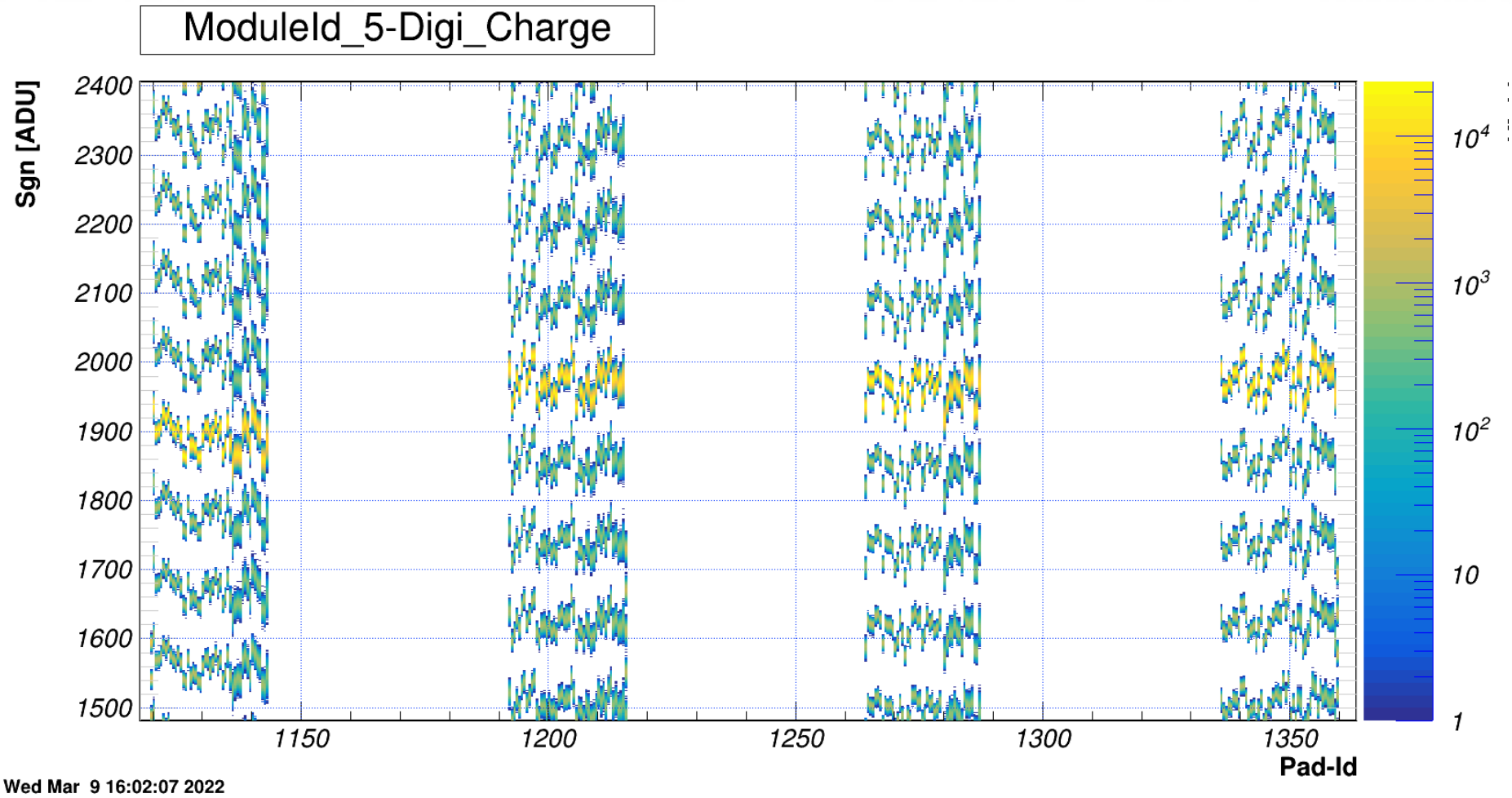
V. Duta et al., Rama Detector

mCBM 2022

Provide TRD v22d as of March 9th for Carbon beam data taking



Dry runs (2046)

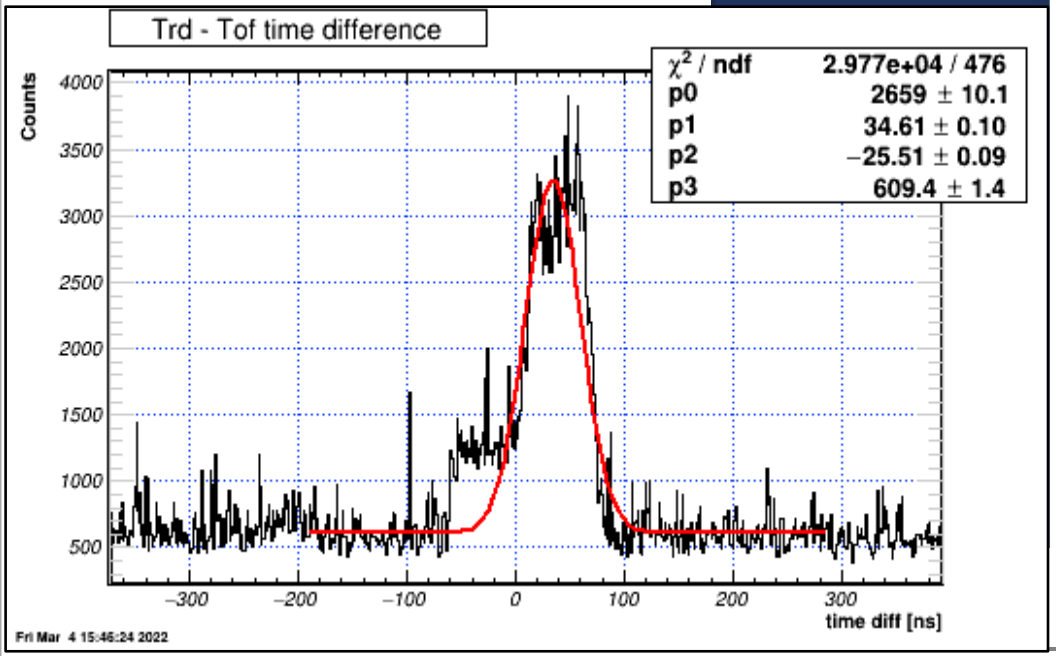


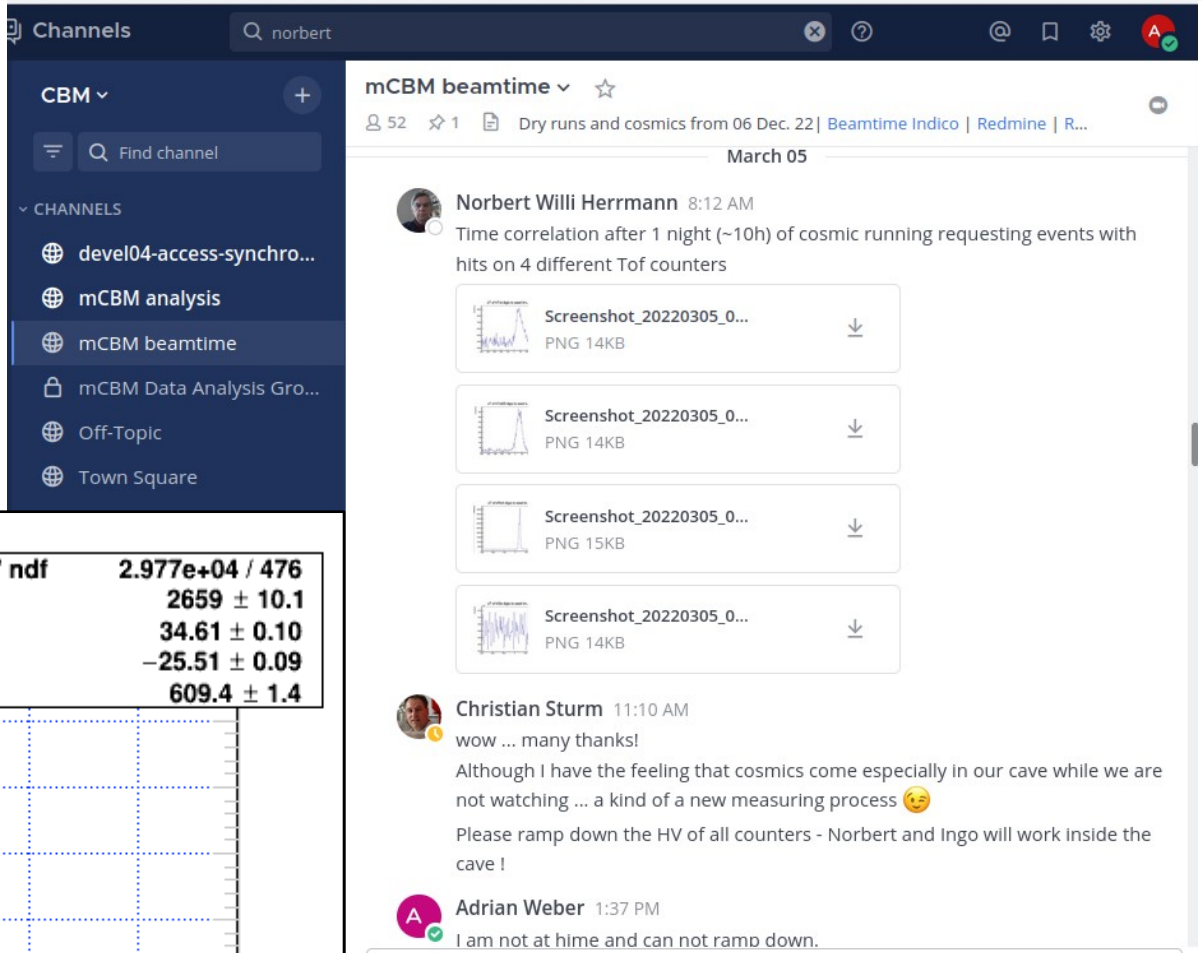
Pulser calibration

→ 2 FASPRO, FASP ids 0 – 11

→ Signal 600 – 2000 / 100 mV

Cosmic Rays (2006)





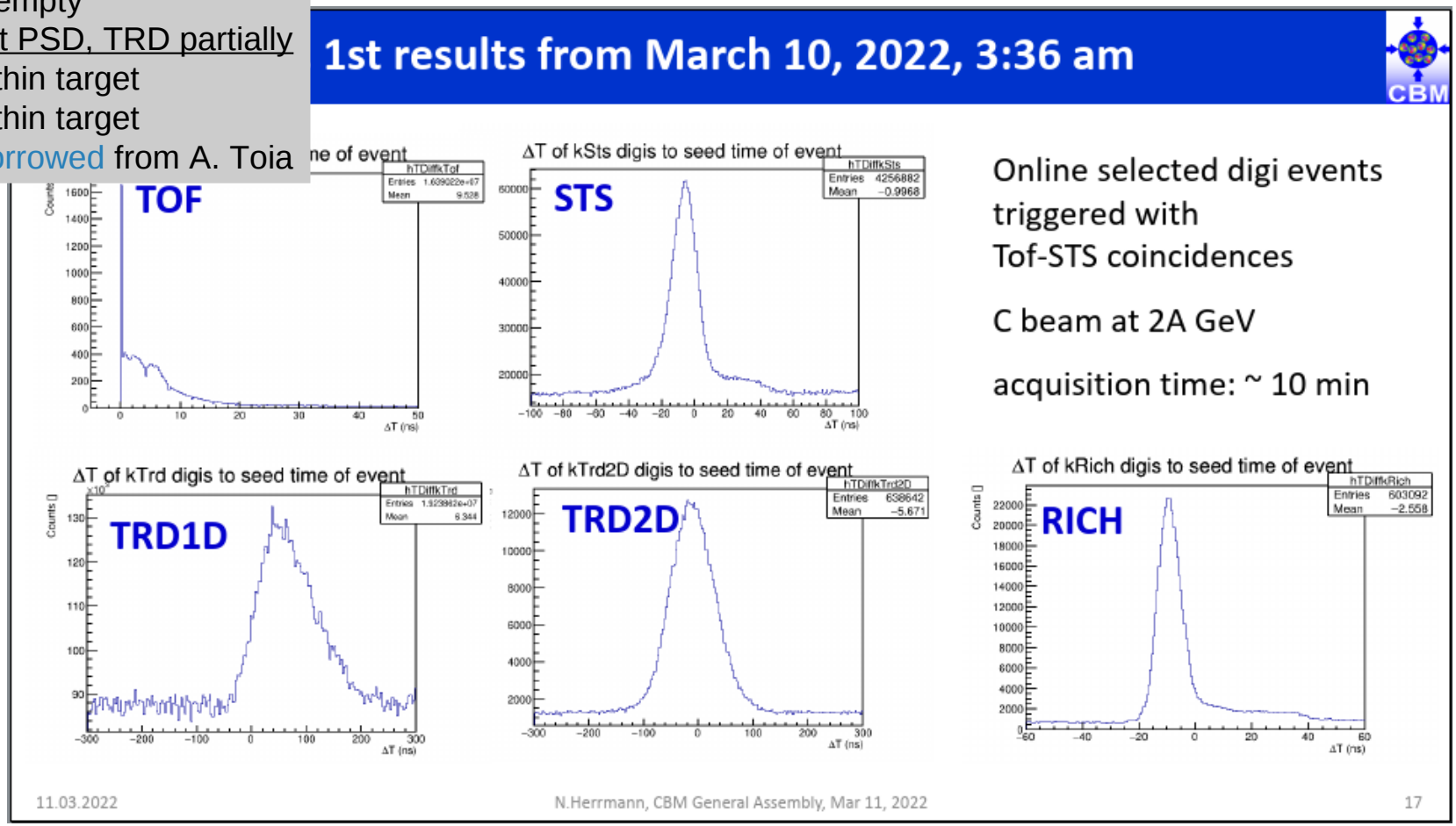
N. Herrmann, Online monitoring

C – Ni @ 1.96 AGeV on 10.03.2022 (2060, 2061, 2062, 2064, 2065)

all except PSD, GEM2
→ 2060 thick target
→ 2061 thin target
→ 2062 empty
all except PSD, TRD partially
→ 2064 thin target
→ 2065 thin target
borrowed from A. Toia

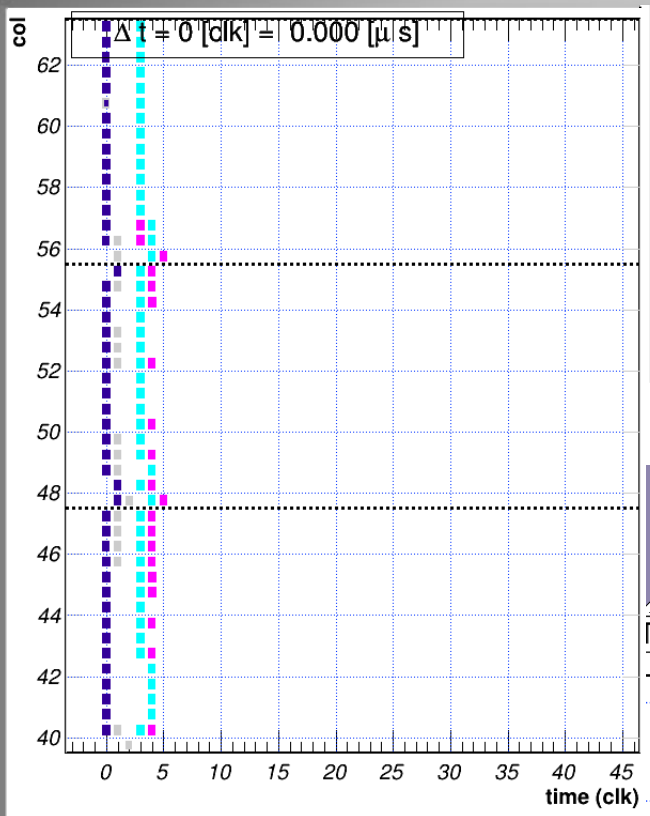
N. Herrmann, CBM Boards summary

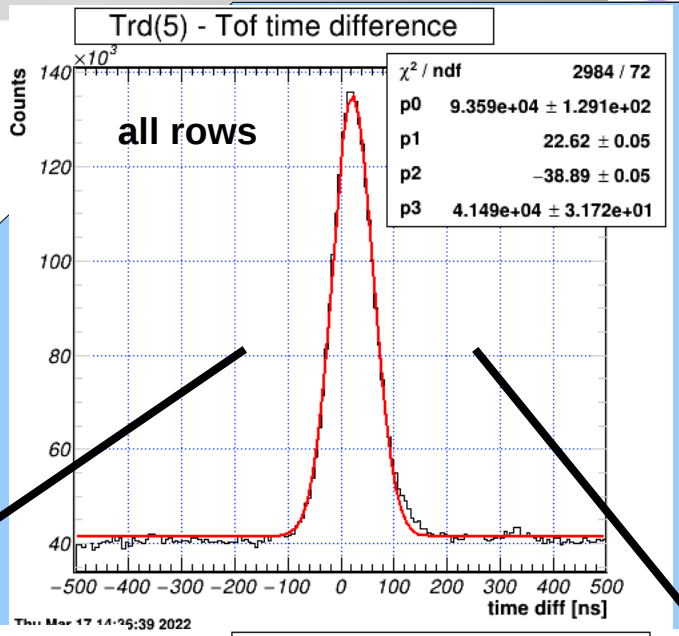
1st results from March 10, 2022, 3:36 am

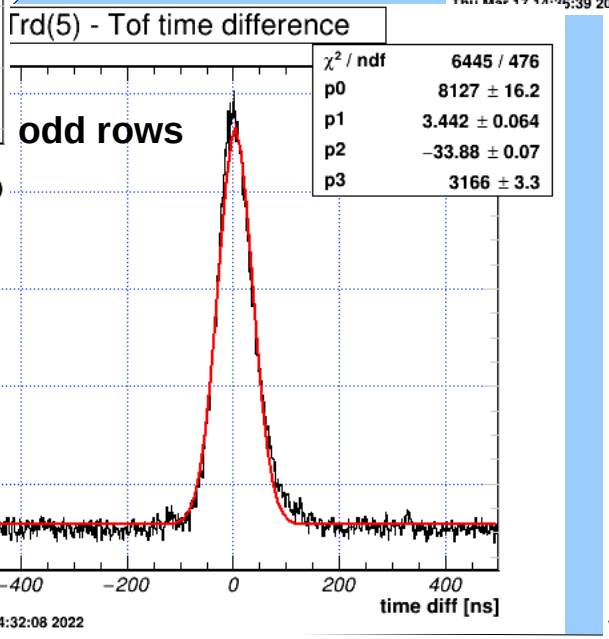


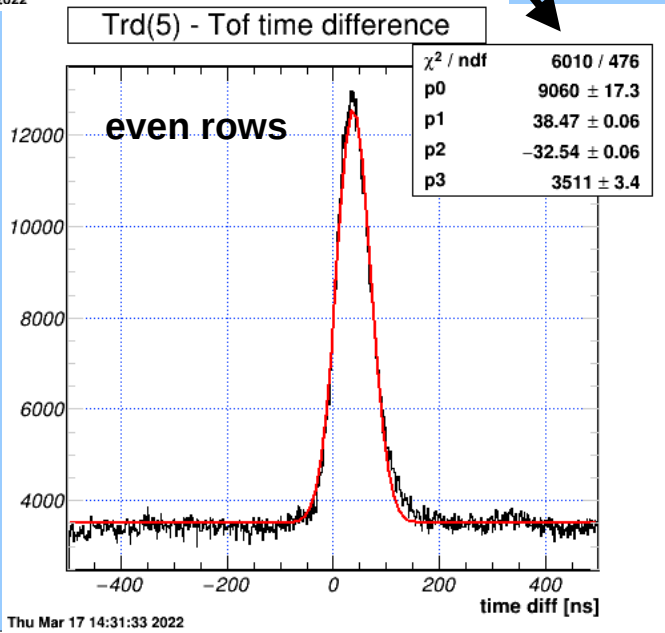
A. Bercuci, C-Ni 1.96 AGeV mCBM 10th March 2022

… a particularly beautiful result …



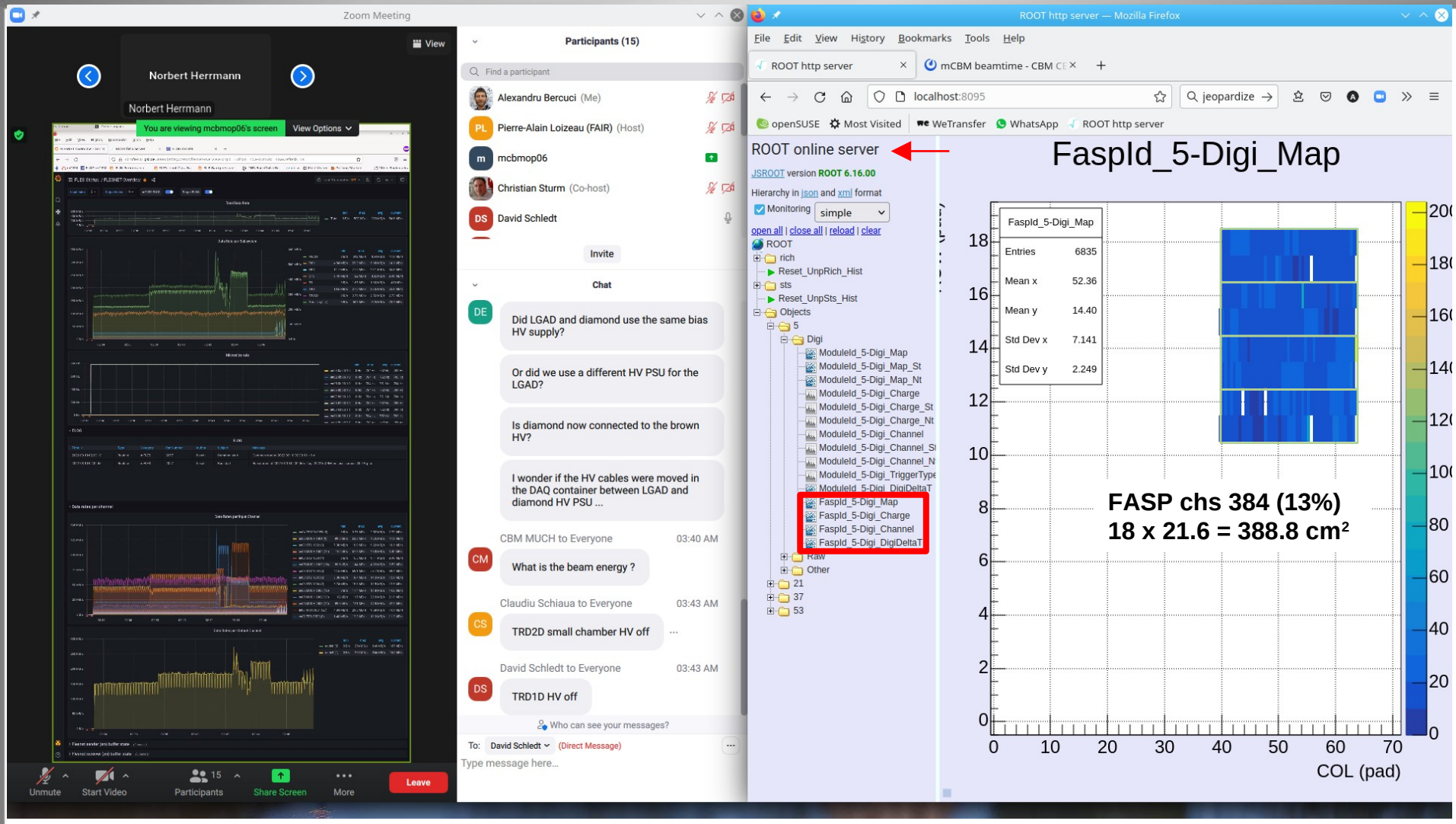




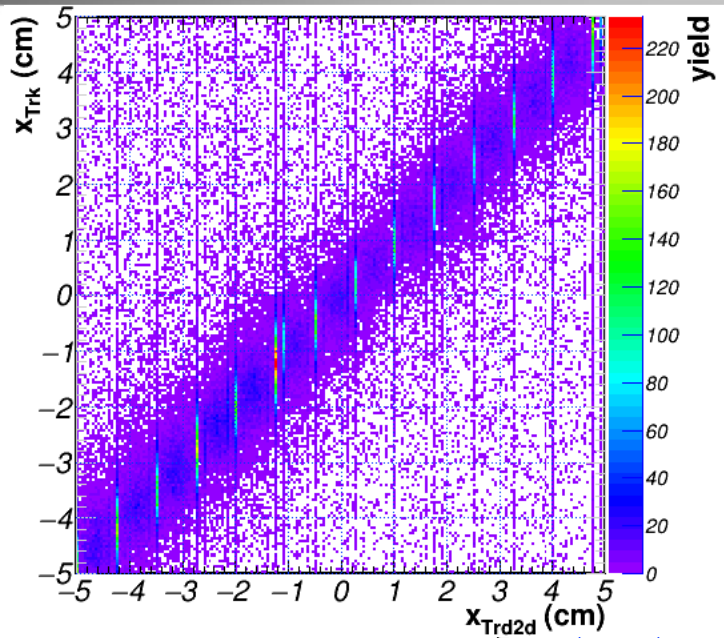


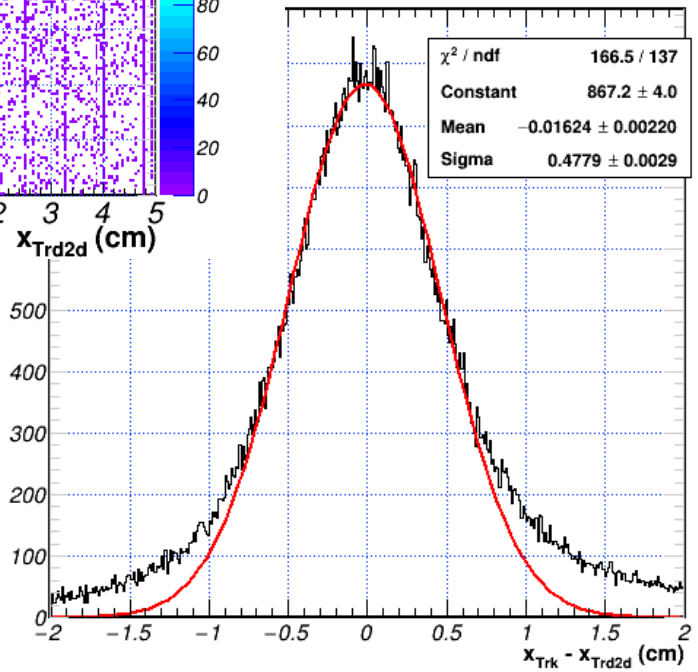
18th March 2022

Monitoring FASP-DAQ and .... detector shifts

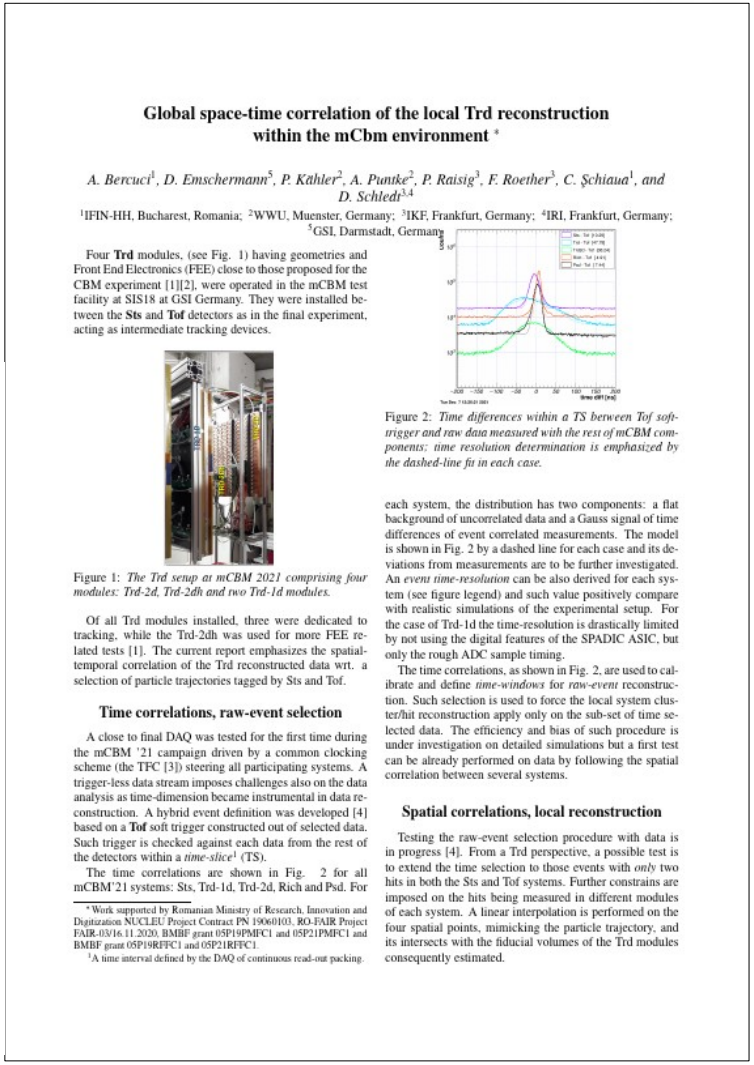


mCBM 2021 reconstruction





Anode wire identification was not proved yet @ mCBM probably due to some shortcomings in the signal processing



Global space-time correlation of the local Trd reconstruction within the mCbm environment *

A. Bercuci[1], D. Emschermann[5], P. Kähler[2], A. Puntke[2], P. Raisig[3], F. Roether[3], C. Şchiaua[1], and D. Schledt[3,4]

[1]IFIN-HH, Bucharest, Romania; [2]WWU, Muenster, Germany; [3]IKF, Frankfurt, Germany; [4]IRI, Frankfurt, Germany; [5]GSI, Darmstadt, Germany

Four **Trd** modules, (see Fig. 1) having geometries and Front End Electronics (FEE) close to those proposed for the CBM experiment [1][2], were operated in the mCBM test facility at SIS18 at GSI Germany. They were installed between the **Sts** and **Tof** detectors as in the final experiment, acting as intermediate tracking devices.

Figure 1: *The Trd setup at mCBM 2021 comprising four modules: Trd-2d, Trd-2dh and two Trd-1d modules.*

Of all Trd modules installed, three were dedicated to tracking, while the Trd-2dh was used for more FEE related tests [1]. The current report emphasizes the spatial-temporal correlation of the Trd reconstructed data wrt. a selection of particle trajectories tagged by Sts and Tof.

Time correlations, raw-event selection

A close to final DAQ was tested for the first time during the mCBM '21 campaign driven by a common clocking scheme (the TFC [3]) steering all participating systems. A trigger-less data stream imposes challenges also on the data analysis as time-dimension became instrumental in data reconstruction. A hybrid event definition was developed [4] based on a **Tof** soft trigger constructed out of selected data. Such trigger is checked against each data from the rest of the detectors within a *time-slice*[1] (TS).

The time correlations are shown in Fig. 2 for all mCBM'21 systems: Sts, Trd-1d, Trd-2d, Rich and Psd. For each system, the distribution has two components: a flat background of uncorrelated data and a Gauss signal of time differences of event correlated measurements. The model is shown in Fig. 2 by a dashed line for each case and its deviations from measurements are to be further investigated. An *event time-resolution* can be also derived for each system (see figure legend) and such value positively compare with realistic simulations of the experimental setup. For the case of Trd-1d the time-resolution is drastically limited by not using the digital features of the SPADIC ASIC, but only the rough ADC sample timing.

Figure 2: *Time differences within a TS between Tof soft-trigger and raw data measured with the rest of mCBM components: time resolution determination is emphasized by the dashed-line fit in each case.*

The time correlations, as shown in Fig. 2, are used to calibrate and define *time-windows* for *raw-event* reconstruction. Such selection is used to force the local system cluster/hit reconstruction apply only on the sub-set of time selected data. The efficiency and bias of such procedure is under investigation on detailed simulations but a first test can be already performed on data by following the spatial correlation between several systems.

Spatial correlations, local reconstruction

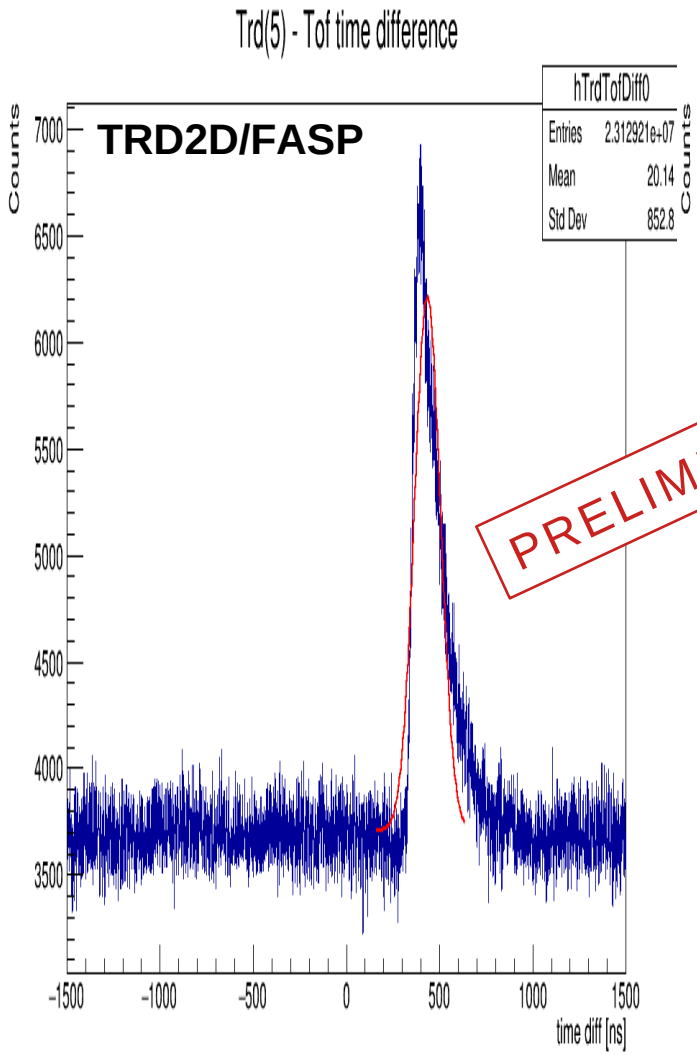
Testing the raw-event selection procedure with data is in progress [4]. From a Trd perspective, a possible test is to extend the time selection to those events with *only* two hits in both the Sts and Tof systems. Further constrains are imposed on the hits being measured in different modules of each system. A linear interpolation is performed on the four spatial points, mimicking the particle trajectory, and its intersects with the fiducial volumes of the Trd modules consequently estimated.

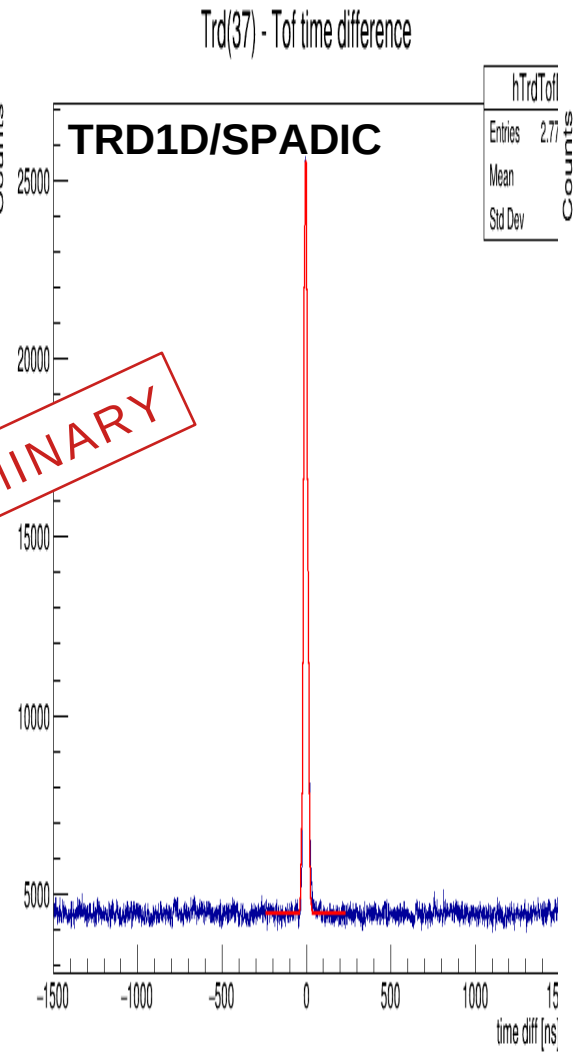
* Work supported by Romanian Ministry of Research, Innovation and Digitization NUCLEU Project Contract PN 19060103, RO-FAIR Project FAIR-03/16.11.2020, BMBF grant 05P19PMFC1 and 05P21PMFC1 and BMBF grant 05P19RFFC1 and 05P21RFFC1.

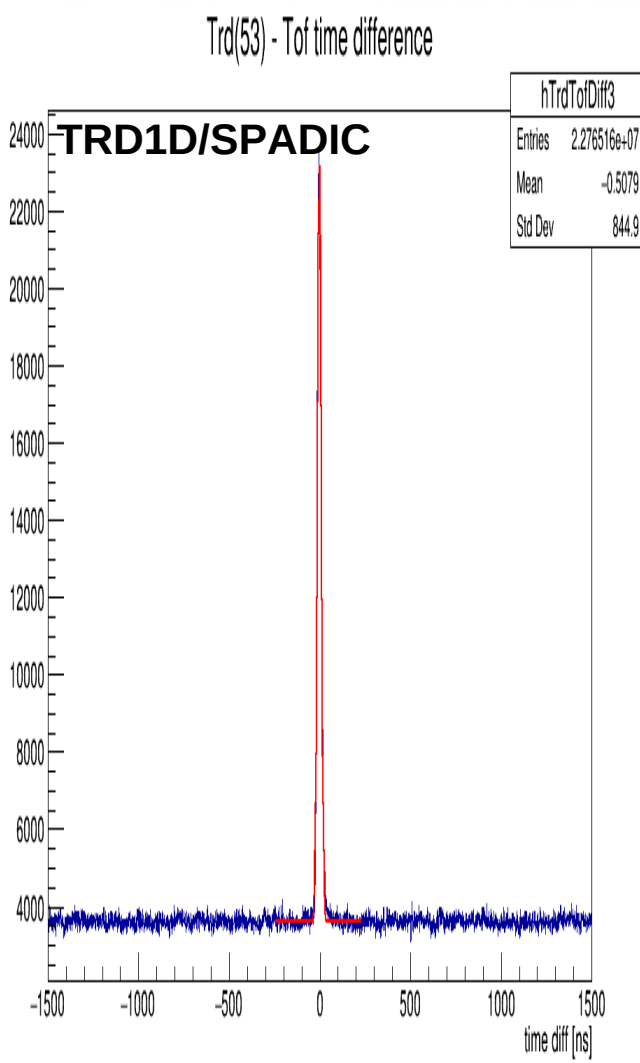
[1]A time interval defined by the DAQ of continuous read-out packing.

A. Bercuci et al., *Global space-time correlation of the local Trd reconstruction within the mCbm environment,* CBM Progress Report 2021, in preparation

mCBM '21-'22 simulations (A. Nan)

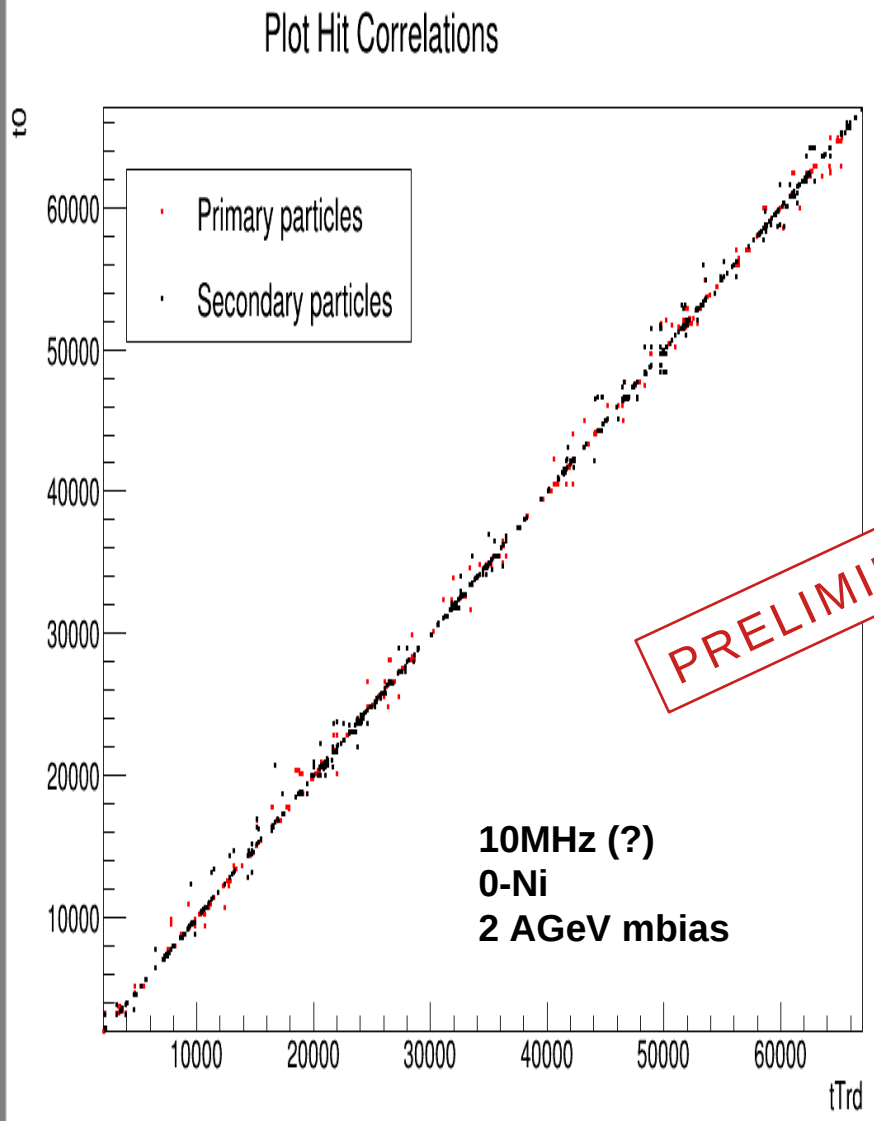


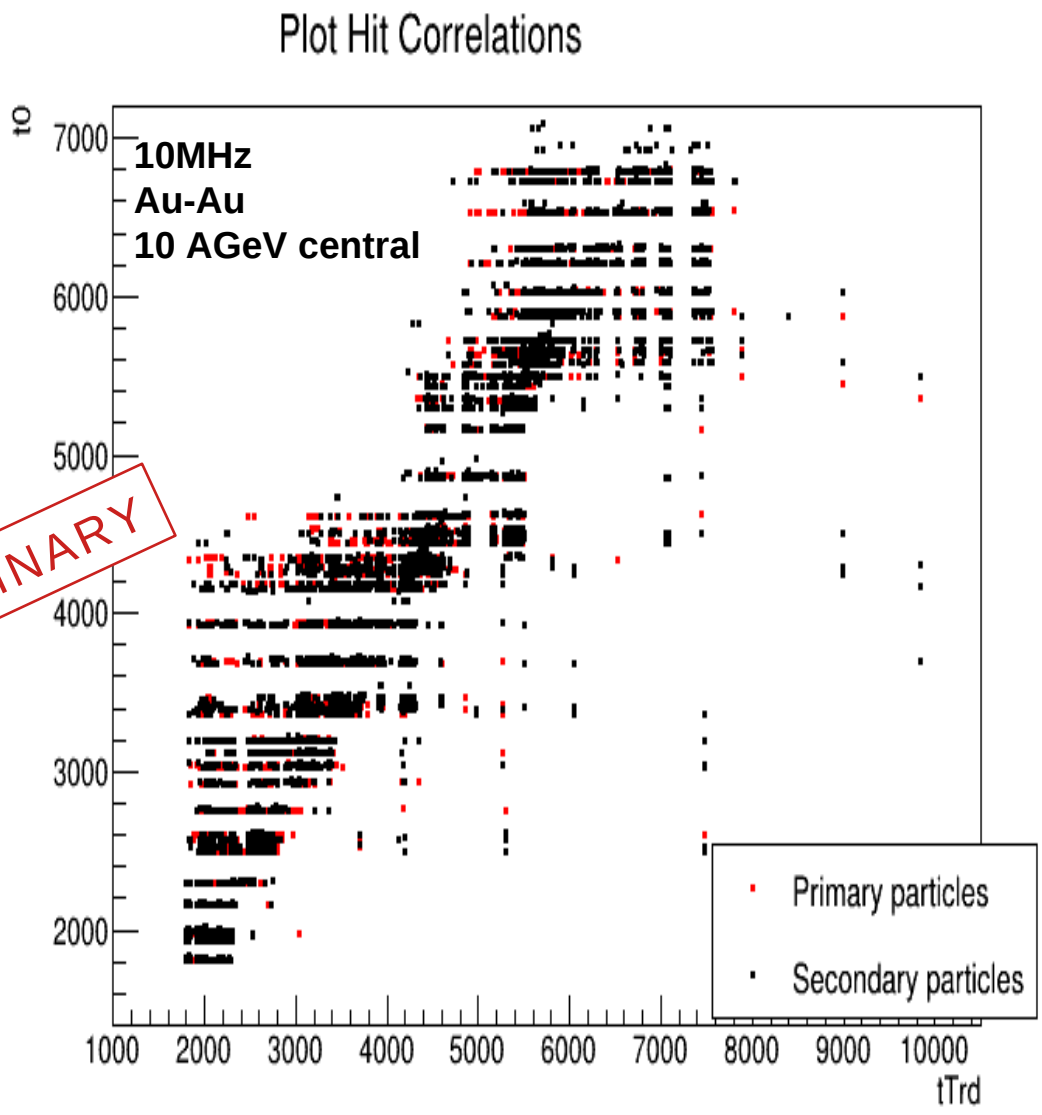




PRELIMINARY

mCBM '21-'22 simulations (A. Nan)



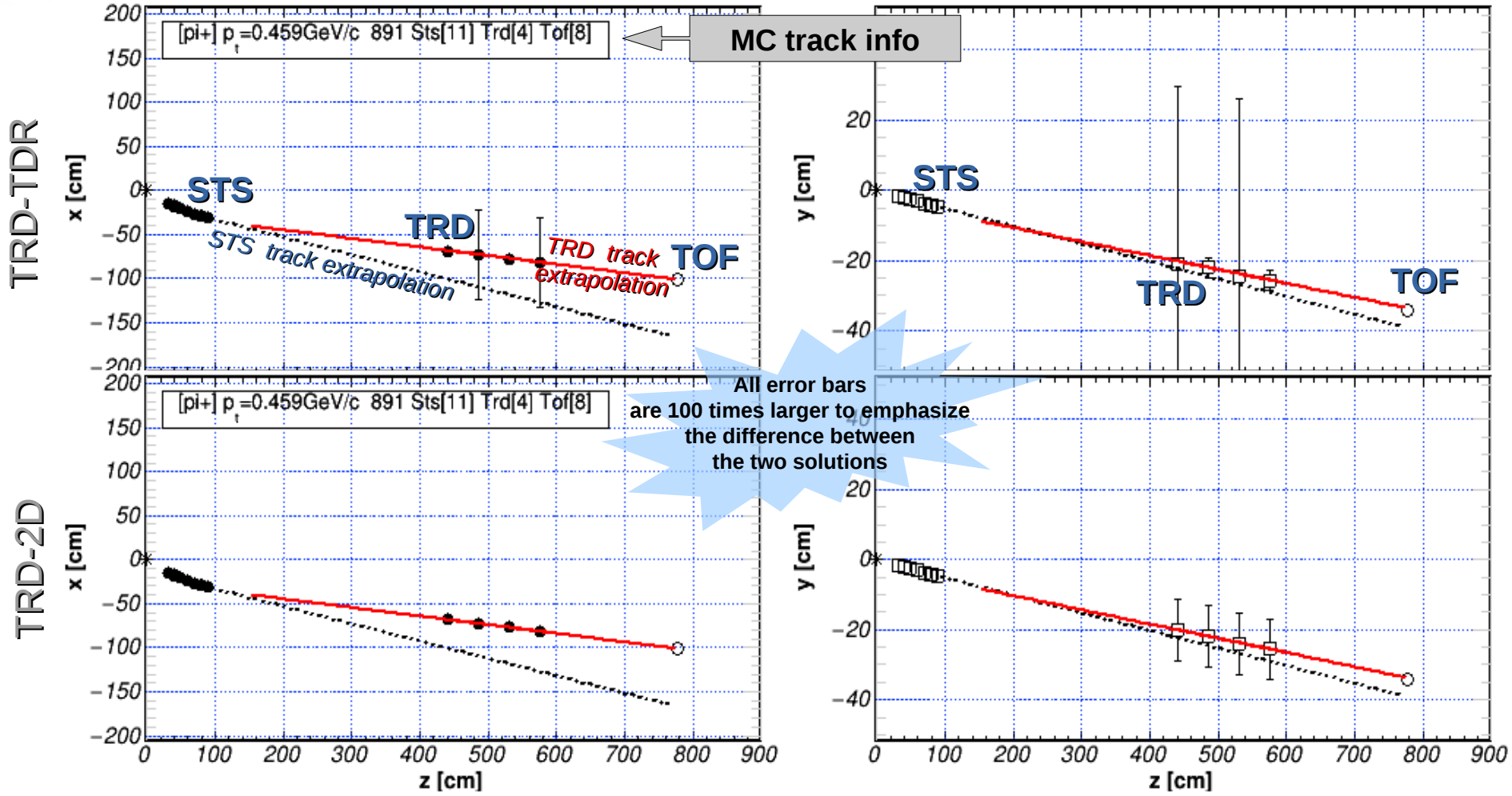


PRELIMINARY

Thank You !

BACKUP

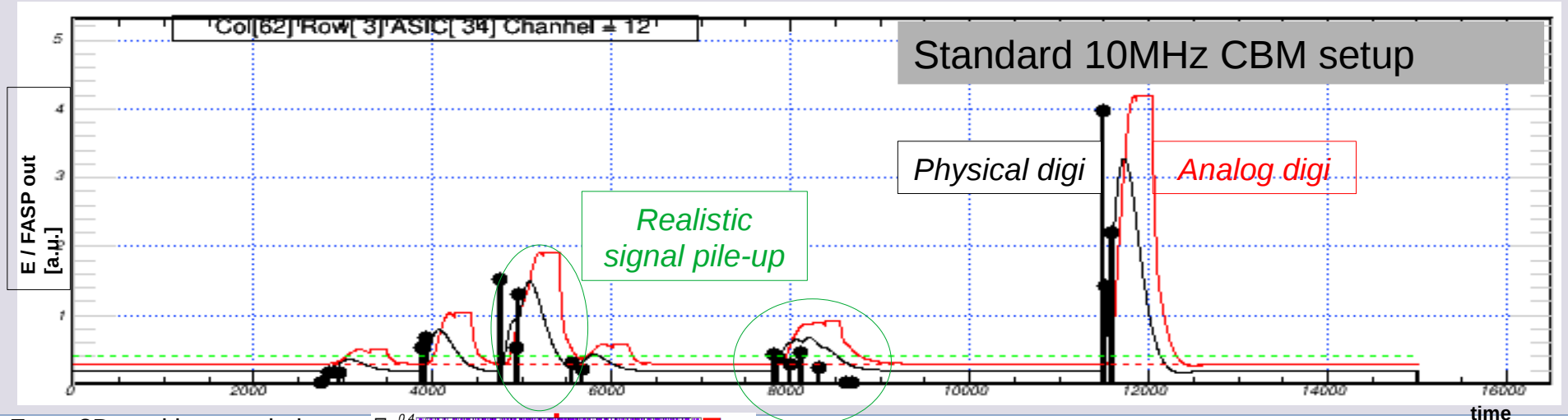
Standalone/complementary TRD tracking



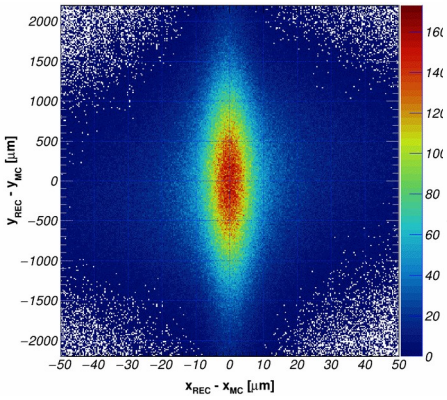
TRD track extrapolation : linear fit of ideally reconstructed TRD hit extrapolated to STS and ToF (z of MC point)

→ see next slide for ideal reconstructed TRD hit definition

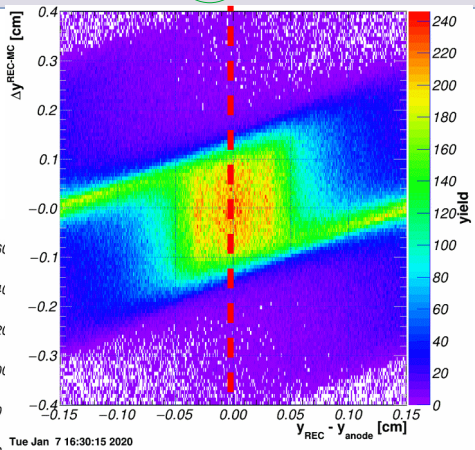
CbmRoot integration : Digitization → Reconstruction → Tracking → *Physics*

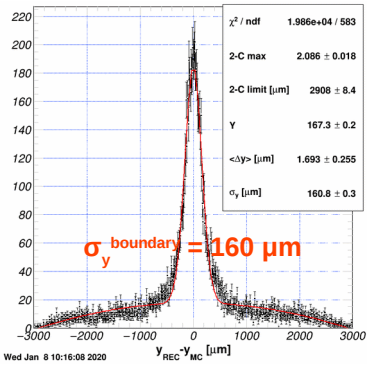


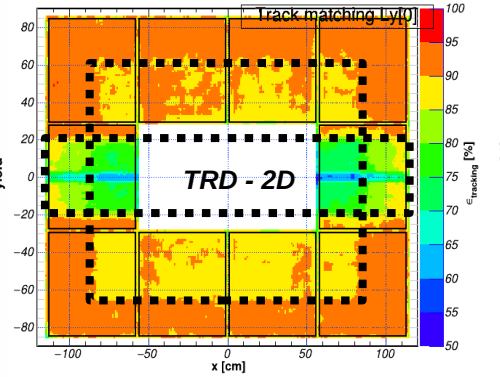
From 2D position resolution to tracking efficiency in SIS100 set-up EbyE simulations.

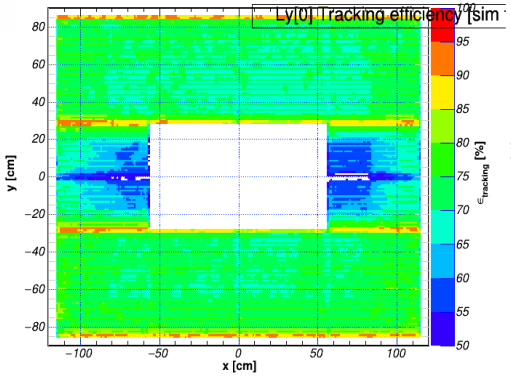


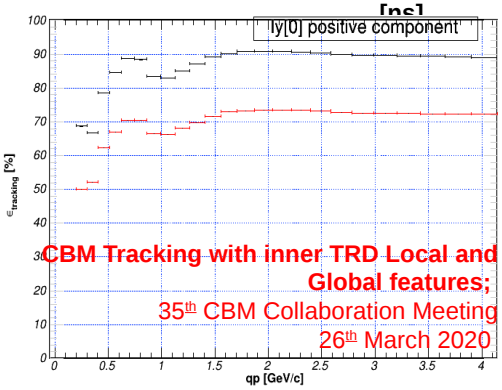
Differential y resolution over the amplification cell with emphasis on the best resolution of σ_y=160μm.



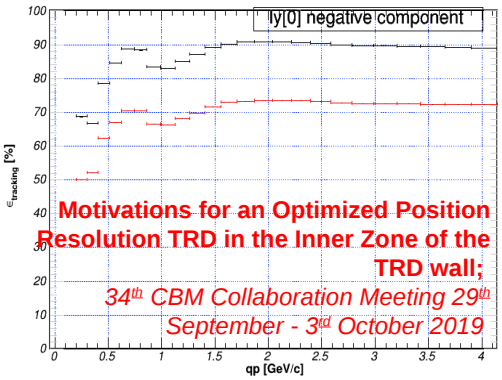








CBM Tracking with inner TRD Local and Global features;
35th CBM Collaboration Meeting
26th March 2020



Motivations for an Optimized Position Resolution TRD in the Inner Zone of the TRD wall;
34th CBM Collaboration Meeting 29th September - 3rd October 2019